CLAIMS

1. A method of processing data for transmission in a wireless multi-antenna orthogonal frequency division multiplexing (OFDM) communication system, the method comprising:

coding traffic data in accordance with a coding scheme to obtain coded data;

interleaving the coded data in accordance with an interleaving scheme to obtain interleaved data;

symbol mapping the interleaved data in accordance with a modulation scheme to obtain a stream of data symbols; and

processing each pair of data symbols in the stream to obtain two pairs of transmit symbols for transmission from a pair of antennas, wherein each transmit symbol is a version of a data symbol.

2. The method of claim 1, wherein the two pairs of transmit symbols for each pair of data symbols are transmitted from a pair of antennas on the same subband in two OFDM symbol periods.

3. The method of claim 1, wherein the two pairs of transmit symbols for each pair of data symbols are transmitted from a pair of antennas on two subbands in one OFDM symbol period.

4. The method of claim 1, wherein N antennas are available for data transmission and $N_T \cdot (N_T - 1)/2$ different pairs of antennas are used to transmit pairs of data symbols in the stream, where $N > 2$.

5. The method of claim 1, wherein a plurality of subbands are used for data transmission, and wherein different pairs of antennas are used for adjacent subbands used for data transmission.

6. The method of claim 1, wherein the system supports a first OFDM symbol size with S subbands and a second OFDM symbol size with L subbands, where S is an integer greater than one and L is an integer multiple of S.

7. The method of claim 6, further comprising:

forming a plurality of streams of transmit symbols for a plurality of antennas; and

transforming each stream of transmit symbols in accordance with the first or second OFDM symbol size to obtain a corresponding stream of OFDM symbols.

8. The method of claim 1, wherein the coding includes:

coding the traffic data in accordance with a base code to obtain code bits at a fixed code rate, and

puncturing the code bits at the fixed code rate to obtain the coded data comprised of code bits at one of a plurality of code rates supported by the system.

9. The method of claim 8, wherein the base code is a rate 1/2 convolutional code.

10. The method of claim 8, wherein the plurality of code rates are associated with a plurality of puncturing patterns.

11. The method of claim 1, wherein the coding includes:

coding the traffic data in accordance with a base code to obtain code bits at a fixed code rate, and

repeating the code bits at the fixed code rate to obtain the coded data comprised of code bits at a lower code rate than the fixed code rate.

12. The method of claim 1, wherein the interleaving includes:

forming sequences of code bits from the coded data, and

for each of the sequences, mapping each code bit in the sequence to one of a plurality of subbands based on the interleaving scheme.

13. The method of claim 12, wherein each sequence of code bits is designated for transmission on the plurality of subbands in one OFDM symbol period.

14. The method of claim 1, wherein the interleaving includes:

forming sequences of code bits from the coded data,

partitioning each of the sequences into M blocks of code bits for transmission on M disjoint groups of subbands, one block of code bits for each group of subbands, where $M \geq 2$, and

for each of the M blocks for each sequence, mapping each code bit in the block to one of the subbands in the group for the block based on the interleaving scheme.

15. The method of claim 1, wherein the symbol mapping includes

grouping sets of B bits in the interleaved data to form B-bit binary values, where $B \geq 1$, and

mapping each of the B-bit binary values to a data symbol based on the modulation scheme, wherein the modulation scheme is defined with Gray mapping such that two adjacent data symbols in a signal constellation for the modulation scheme differ by at most one bit among B bits.

16. The method of claim 15, wherein the symbol mapping further includes

reordering the B bits for each of the sets, and wherein the sets of reordered B bits are used to form the B-bit binary values.

17. A transmitter in a wireless multi-antenna orthogonal frequency division multiplexing (OFDM) communication system, comprising:

an encoder operative to encode traffic data in accordance with a coding scheme to obtain coded data;

an interleaver operative to interleave the coded data in accordance with an interleaving scheme to obtain interleaved data;

a symbol mapping unit operative to symbol map the interleaved data in accordance with a modulation scheme to obtain a stream of data symbols; and

a transmit spatial processor operative to process each pair of data symbols in the stream to obtain two pairs of transmit symbols for transmission from a pair of antennas, wherein each transmit symbol is a version of a data symbol.

18. The transmitter of claim 17, wherein the transmit spatial processor is operative to implement space-time transmit diversity and provide the two pairs of transmit symbols for each pair of data symbols in two OFDM symbol periods.

19. The transmitter of claim 17, wherein the transmit spatial processor is operative to implement space-frequency transmit diversity and provide the two pairs of transmit symbols for each pair of data symbols on two subbands.

20. The transmitter of claim 17, wherein the system supports a first OFDM symbol size with S subbands and a second OFDM symbol size with L subbands, where S is an integer greater than one and L is an integer multiple of S.

21. The transmitter of claim 20, further comprising:

a plurality of modulators for a plurality of antennas, each modulator operative to transform a stream of transmit symbols for an associated antenna to obtain a corresponding stream of OFDM symbols for the antenna.

22. An apparatus in a wireless multi-antenna orthogonal frequency division multiplexing (OFDM) communication system, comprising:

means for coding traffic data in accordance with a coding scheme to obtain coded data;

means for interleaving the coded data in accordance with an interleaving scheme to obtain interleaved data;

means for symbol mapping the interleaved data in accordance with a modulation scheme to obtain a stream of data symbols; and

means for processing each pair of data symbols in the stream to obtain two pairs of transmit symbols for transmission from a pair of antennas, wherein each transmit symbol is a version of a data symbol.

23. The apparatus of claim 22, wherein the two pairs of transmit symbols for each pair of data symbols are transmitted from a pair of antennas in two OFDM symbol periods.

24. The apparatus of claim 22, wherein the two pairs of transmit symbols for each pair of data symbols are transmitted from a pair of antennas on two subbands.

25. The apparatus of claim 22, wherein the system supports a first OFDM symbol size with S subbands and a second OFDM symbol size with L subbands, where S is an integer greater than one and L is an integer multiple of S.

26. The apparatus of claim 25, further comprising:

means for forming a plurality of streams of transmit symbols for a plurality of antennas; and

means for transforming each stream of transmit symbols in accordance with the first or second OFDM symbol size to obtain a corresponding stream of OFDM symbols.

27. A method of processing data for transmission in a wireless multi-antenna communication system, the method comprising:

coding traffic data in accordance with a coding scheme to obtain coded data;

interleaving the coded data in accordance with an interleaving scheme to obtain interleaved data;

symbol mapping the interleaved data in accordance with a modulation scheme to obtain a stream of data symbols; and

demultiplexing the stream of data symbols such that each pair of data symbols in the stream is transmitted from a pair of antennas and consecutive pairs of data symbols in the stream are transmitted from different pairs of antennas.

28. The method of claim 27, wherein the demultiplexing is further such that each code bit of the coded data is transmitted from a maximum number of antennas achievable for the code bit based on a code rate of the code bit.

29. The method of claim 27, wherein the MIMO system implements orthogonal frequency division multiplexing (OFDM).

30. The method of claim 29, wherein each pair of data symbols in the stream is transmitted from a pair of antennas on one subband, and wherein pairs of data symbols for adjacent subbands are transmitted on different pairs of antennas.

31. The method of claim 29, wherein each group of S code bits for the coded data is interleaved, where S is the number of subbands used for data transmission.

32. A method of processing data for transmission in a wireless multi-antenna orthogonal frequency division multiplexing (OFDM) communication system, the method comprising:

coding traffic data in accordance with a coding scheme to obtain coded data;

interleaving the coded data in accordance with an interleaving scheme to obtain interleaved data;

symbol mapping the interleaved data in accordance with a modulation scheme to obtain a stream of data symbols; and

demultiplexing the stream of data symbols such that each pair of data symbols in the stream is transmitted from a pair of antennas on two subbands.

33. The method of claim 32, wherein each pair of data symbols in the stream is transmitted on two adjacent subbands usable for data transmission.

34. The method of claim 32, further comprising:

processing each pair of data symbols in the stream to obtain first and second pairs of transmit symbols, each transmit symbol being a version of one of the data symbols in the pair of data symbols, wherein the first pair of transmit symbols is transmitted from the pair of antennas on a first subband and the second pair of transmit symbols is transmitted from the pair of antennas on a second subband.

35. The method of claim 34, wherein the first and second pairs of transmit symbols are transmitted concurrently in one OFDM symbol period on the first and second subbands, respectively.

36. A method of processing data at a receiver in a wireless multi-antenna orthogonal frequency division multiplexing (OFDM) communication system, the method comprising:

obtaining a stream of vectors of received symbols, each vector including N received symbols for N receive antennas, where N is one or greater;

processing each pair of vectors of received symbols in the stream to obtain two recovered data symbols, which are estimates of two data symbols transmitted as two pairs of transmit symbols from two transmit antennas, each transmit symbol being a version of a data symbol, wherein a stream of recovered data symbols is obtained for the stream of vectors of received symbols;

symbol demapping the stream of recovered data symbols in accordance with a demodulation scheme to obtain demodulated data;

deinterleaving the demodulated data in accordance with a deinterleaving scheme to obtain deinterleaved data; and

decoding the deinterleaved data in accordance with a decoding scheme to obtain decoded data.

37. The method of claim 36, wherein each pair of vectors of received symbols is for two OFDM symbol periods.

38. The method of claim 36, wherein each pair of vectors of received symbols is for two subbands.

39. The method of claim 36, wherein the system supports a first OFDM symbol size with S subbands and a second OFDM symbol size with L subbands, where S is an integer greater than one and L is an integer multiple of S.

40. The method of claim 39, further comprising:

transforming a stream of samples for each of the N receive antennas in accordance with the first or second OFDM symbol size to obtain a corresponding stream of received symbols for the receive antenna, and wherein the stream of vectors of received symbols is obtained from N streams of received symbols for the N receive antennas.

41. The method of claim 36, wherein N = 1 and each vector includes one received symbol for one receive antenna.

42. The method of claim 36, wherein N > 1 and each vector includes multiple received symbols for multiple receive antennas.

43. A receiver in a wireless multi-antenna orthogonal frequency division multiplexing (OFDM) communication system, comprising:

a receive spatial processor operative to receive a stream of vectors of received symbols and process each pair of vectors of received symbols in the stream to obtain two recovered data symbols, which are estimates of two data symbols transmitted as two pairs of transmit symbols from two transmit antennas, each transmit symbol being a version of a data symbol, wherein each vector includes N received symbols for N receive antennas, where N is one or greater, and wherein a stream of recovered data symbols is obtained for the stream of vectors of received symbols;

a symbol demapping unit operative to symbol demap the stream of recovered data symbols in accordance with a demodulation scheme to obtain demodulated data;

a deinterleaver operative to deinterleave the demodulated data in accordance with a deinterleaving scheme to obtain deinterleaved data; and

a decoder operative to decode the deinterleaved data in accordance with a decoding scheme to obtain decoded data.

44. The receiver of claim 43, wherein each pair of vectors of received symbols is for two OFDM symbol periods.

45. The receiver of claim 43, wherein each pair of vectors of received symbols is for two subbands.

46. The receiver of claim 43, wherein the system supports a first OFDM symbol size with S subbands and a second OFDM symbol size with L subbands, where S is an integer greater than one and L is an integer multiple of S.

47. The receiver of claim 46, further comprising:

N demodulators for the N receive antennas, each demodulator operative to transform a stream of samples for an associated receive antenna in accordance with the first or second OFDM symbol size to obtain a corresponding stream of received symbols for the receive antenna, and wherein the stream of vectors of received symbols is obtained from N streams of received symbols for the N receive antennas.

48. An apparatus in a wireless multi-antenna orthogonal frequency division multiplexing (OFDM) communication system, comprising:

means for obtaining a stream of vectors of received symbols, each vector including N received symbols for N receive antennas, where N is one or greater;

means for processing each pair of vectors of received symbols in the stream to obtain two recovered data symbols, which are estimates of two data symbols transmitted as two pairs of transmit symbols from two transmit antennas, each transmit symbol being a version of a data symbol, wherein a stream of recovered data symbols is obtained for the stream of vectors of received symbols;

means for symbol demapping the stream of recovered data symbols in accordance with a demodulation scheme to obtain demodulated data;

means for deinterleaving the demodulated data in accordance with a deinterleaving scheme to obtain deinterleaved data; and

means for decoding the deinterleaved data in accordance with a decoding scheme to obtain decoded data.

49. The apparatus of claim 48, wherein each pair of vectors of received symbols is for two OFDM symbol periods.

50. The apparatus of claim 48, wherein each pair of vectors of received symbols is for two subbands.

51. The apparatus of claim 48, wherein the system supports a first OFDM symbol size with S subbands and a second OFDM symbol size with L subbands, where S is an integer greater than one and L is an integer multiple of S.

52. The apparatus of claim 51, further comprising:

means for transforming a stream of samples for each of the N receive antennas in accordance with the first or second OFDM symbol size to obtain a corresponding stream of received symbols for the receive antenna, and wherein the stream of vectors of received symbols is obtained from N streams of received symbols for the N receive antennas.